

LEAD-BASED PAINT IN SOIL : WHEN WORLDS COLLIDE – CERCLA MEETS HUD

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ABSTRACT

Controversies have arisen over paradigms used in cleaning up lead released to soil from lead-based paint (LBP). Lead released to soil from LBP can be managed as CERCLA waste. Such waste and potential risks from exposure can be characterized by US EPA Risk Assessment Guidance for Superfund or less restrictive guidance from US Dept. of Housing and Urban Development (HUD). We use a California example to illustrate how differing policy goals affect risk-based decisions. Fifty-two of 560 former military housing units in Novato, CA, were characterized for LBP hazards in soil. Lead concentrations in composite and discrete soil samples ranged from <20 to 1,240 mg/kg. Yard-wide average concentrations of lead (per HUD guidance) were below both 400 mg/kg, the screening value from HUD guidelines, and 230 mg/kg, a value derived from site-specific inputs to LeadSpread, DTSC's exposure model. DTSC found that actual exposure areas for young children could be defined by smaller areas (fenced patios, front or back yards). Exposure concentrations for smaller areas were as high as 600 mg/kg for several housing units. Conclusions are summarized below.

INTRODUCTION

Conflict can arise over guidance for remediation of hazardous waste property contaminated with lead based paint (LBP). US EPA, under Section 403 of the Toxic Substances Control Act (TSCA), established standards for LBP hazards to supplement existing guidance of the US Dept of Housing and Urban Development (HUD). This guidance utilizes generic cleanup standards designed to balance cost of cleanup versus affordability of low cost public housing. The California Dept. of Toxic Substances Control (DTSC) under State and Federal CERCLA guidance utilizes risk assessment to derive site-specific health risk based remedial goals, which are safe for the intended future use. DTSC developed LeadSpread, a lead exposure model to predict blood lead levels and derive remedial goals for lead contaminated soils. Residential remedial goals calculated using LeadSpread with site-specific conditions are generally significantly lower than the generic goals of 400 ppm for bare soils in children's play areas and 1200 ppm for other residential soils established under TSCA. To illustrate what may occur when TSCA/HUD and CERCLA guidances "collide" at a hazardous waste property, we present an example.

The U.S. Department of Defense (DOD) Housing Facility in Novato, California, is a military family residential area built in 1960, and designated for transfer and reuse under the Base Realignment and Closure (BRAC) program. Intended future use of the property is affordable housing for the City of Novato. Disagreement arose during the cleanup process over the guidance to be used in site investigation and assessment. This poster describes the difference in approach for characterization, risk assessment, and cleanup goals under CERCLA guidance with DTSC oversight and under TSCA/HUD guidance.

In 1995, the Navy inspected 22 of the 560 housing units in accordance with HUD criteria for the presence of LBP hazards. LBP was present on the interior and exterior of many of the housing units. Lead detected in soil adjacent to several of the structures warranted further investigation. Two additional phases of investigation were conducted to characterize the distribution of lead in soil around selected housing units.

APPROACHES TO LEAD-BASED PAINT: CERCLA (SUPERFUND) VERSUS HUD/TSCA		
	CERCLA	HUD/TSCA
Application	Hazardous waste sites	Housing; child-occupied facilities
Objective	Identify levels which could result in adverse health effects	Identify levels which would result in adverse health effects
Approach	Flexible, site-specific	Prescriptive
Primary decision criterion	Risk assessment	Cost-benefit
Other decision criteria	Balancing criteria ¹⁻⁴	---
Analytical tools	Models such as IEUBK for predicting blood lead levels	Empirical model for comparing cost-benefit
Sampling design	Open-ended	Prescriptive, finite ^{1b}
Sample method	Discrete samples preferred	Composite samples
Exposure area	Discretionary, directed	Yard-wide
Hot spots	Evaluated	Neither identified nor evaluated
Exposure media	All sources of lead included	Soil and house dust
Population evaluated	Children and adults	Young children
Scenario	Residential and nonresidential	Residential only
Ecological receptors	Evaluated	Not evaluated
Endpoints considered	Child blood lead level above 10 µg/dL	IQ loss; IQ less than 70; blood lead above 20 µg/dL
Recommendation	Site-specific remediation goals	Generic (400 ppm for bare soil play area; 1,200 ppm yard-wide average)
Remedy selection	Permanent preferred	Interim for 400 to 1,200 ppm
Public involvement	One balancing criterion ¹⁻⁴	Not required

a. The nine balancing criteria of CERCLA are (1) protection of human health and the environment, (2) compliance with ARAFs, (3) long-term effectiveness and permanence, (4) reduction in toxicity, mobility, and volume of waste, (5) short-term effectiveness, (6) implementability, (7)

b. A fraction of units is sampled, varying with the total number of units.

METHODS			
Project Phase	Housing Units Sampled	Sampling Approach (a)	Exposure Area/Concentration Term
1	22	<ul style="list-style-type: none"> * HUD: LBP hazard in soil * Two composite samples/unit (n=5) * Front and back or side yard, within dripline 	Composite sample concentrations compared with criterion
2	8 4 units sampled in Phase 1 4 units sampled <i>de novo</i>	<ul style="list-style-type: none"> * HUD, CERCLA, USEPA and DTSC guidance * 16 composite (n=3) "step-out" surface soil samples/unit * Front and back yards * Discrete samples from 6 in. depth at four Phase 1 units * Additional composite and discrete samples from target areas * Eight background samples 	<u>NAVY:</u> Whole yard <ul style="list-style-type: none"> * 95% UCL on geometric or arithmetic mean for all samples for each unit ^(b) * Area-weighted average (AWA): based on average concentration ^(b) and area in step-out zones <u>DTSC:</u> Patios and play areas <ul style="list-style-type: none"> * Average, weighting for number of subsamples ^(b) * Whole yard or patio / play area * Per unit sample-weighted average * Any mid-yard or play area composite sample
3	52 26 units sampled earlier 26 units sampled <i>de novo</i>	<ul style="list-style-type: none"> * HUD Guidelines + Navy and DTSC agreement * One or more composite samples (n=4) * Mid-yard and/or patio/play area 	

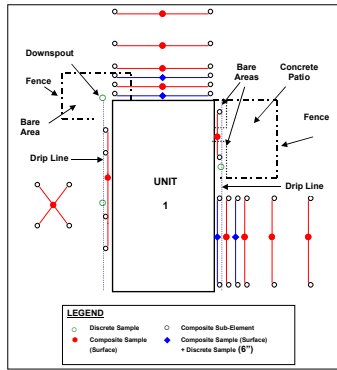
RESULTS			
Project Phase	Range of Soil Lead Concentrations	Exposure Concentration	Decision Criteria And Conclusions
1	11 to 1,200 mg/kg (composite samples)	Not Determined	HUD: >400 mg/kg <ul style="list-style-type: none"> * 4 of 22 units > 400 mg/kg * Resample those four units * Sample four additional units * Do step-outs and targeted sampling.
2	<u>Minimum:</u> 26 mg/kg (4 ft from foundation) <u>Maximum:</u> 950 mg/kg (1 ft from foundation) <u>6 in depth:</u> 12 to 360 mg/kg <u>Downspouts:</u> 61 to 690 mg/kg <u>Patio or play areas:</u> 31 to 920 mg/kg <u>Discrete samples:</u> 35 to 950 mg/kg <u>Background Pb:</u> 12 to 36 mg/kg	<u>NAVY:</u> Whole yard <ul style="list-style-type: none"> * Range of 95% UCL among units: 52 to 360 mg/kg * Range of AWA: 48 to 130 mg/kg <u>DTSC:</u> Patio/Play areas <ul style="list-style-type: none"> * Sample-weighted average * Highest two units: 500 and 460 mg/kg 	LeadSpread: 230 and 490 mg/kg ^(c) (site-specific inputs) <u>NAVY:</u> <ul style="list-style-type: none"> * 95% UCL <490 mg/kg; one unit was >230 mg/kg * No AWA >230 mg/kg * Hot spots infrequent, limited areas * Whole yard poses no risk to children * No further action <u>DTSC:</u> <ul style="list-style-type: none"> * High Pb in patio/play areas * Exposures likely in fenced patios * High variability, sample all units
3	<u>PHASE 3</u> Mid-yard: 16 to 1,240 mg/kg Patio/play area: 30 to 270 mg/kg <u>POOLED DATA (All Phases)</u> <ul style="list-style-type: none"> * Pb typically <100 mg/kg * When >400 mg/kg occurred, usually seen in >1 composite sample. * Five of 52 units had >230 mg/kg in patio/play area or front or back yard. 	<u>PHASES 1, 2, & 3</u> <u>NAVY:</u> <ul style="list-style-type: none"> * Whole yard (8 units): 46 to 250 mg/kg * Patio/Play areas (34 units): 30 to 380 mg/kg <u>DTSC:</u> <ul style="list-style-type: none"> * Front or back yard: maximum = 600 mg/kg * Patio/play areas: maximum = 500 mg/kg 	Navy/DTSC agreement: 400 mg/kg <u>NAVY:</u> <ul style="list-style-type: none"> * Sampling 52 of 560 housing units is adequate. * Small likelihood of significant health effects from exposure to Pb in soil. * No further action. <u>DTSC:</u> <ul style="list-style-type: none"> * Patio areas might pose risk to children. * Sample patio/play areas of all units. * Remedial action may be warranted.

a: Except where noted, the upper one-half inch of soil was sampled after first removing any debris or overlying sod.

b: Statistical determinations by the Navy for Phase 2 did not distinguish between composite and discrete samples. In calculating average concentrations, DTSC weighted composite samples by the number of subsamples.



UNIT 1 BACK YARD



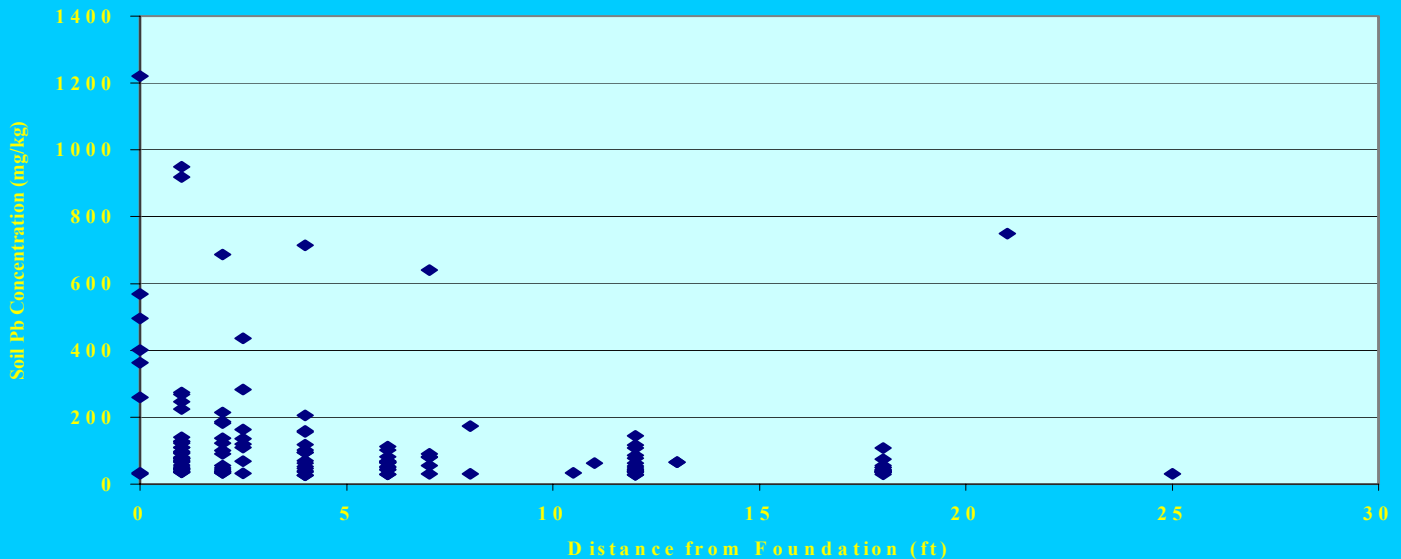
UNIT 1 PATIO

HOUSING UNIT 1

Phase	Sample Location	Distance ^a (FT)	Number of Subsamples (Discrete n=1)	Soil Lead Concentration (mg/kg)	Exposure Concentration
1	Side yard	0	5	34	Not estimated.
1	Front yard	0	5	500	
2	Downspout	2	1	690	NAVY: Whole yard • 95% UCL of geometric mean--360 mg/kg • Area-weighted average--130 mg/kg DTSC: • Patio area, Sample-weighted average--420 mg/kg
2	Front yard	2	1	140	
2	Side yard	1	3	250	
2	Side yard	2.5	3	280	
2	Side yard	4	3	95	
2	Side yard	6	3	81	
2	Side yard	12	3	140	
2	Side yard	18	3	110	
2	Back yard	1	3	120	Combined Data for Phases 1, 2, and 3 NAVY: Whole yard • Average--220 mg/kg • Sample-weighted average--260 mg/kg Patio, Sample-weighted average -- 260 mg/kg (Excludes 950 mg/kg discrete sample) DTSC: Front yard, Sample-weighted average--590 mg/kg Patio, Sample-weighted average--340 mg/kg
2	Back yard	2.5	3	440	
2	Back yard	4	3	120	
2	Back yard	6	3	100	
2	Back yard	12	3	54	
2	Back yard	18	3	75	
2	Patio	1	3	270	
2	Patio	1	1	950	
3	Patio	1	5	270	
3	Front yard	21	5	750	

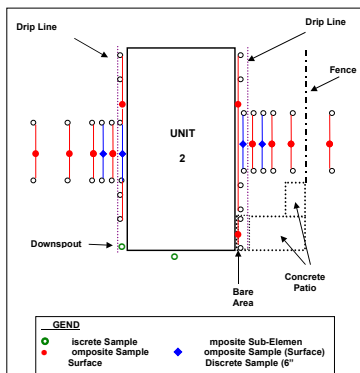
^a Distance from house foundation

Soil Lead (Pb) Concentration vs. Distance from House Foundation





UNIT 2 FRONT YARD



UNIT 2 PATIO

HOUSING UNIT 2

Phase	Sample Location	Distance ^a (ft)	Number of Subsamples (discrete n=1)	Soil Sample Lead Concentration (mg/kg)	Exposure Concentration
1	Front yard	0	5	260	Not estimated.
1	Back yard/patio	0	5	1,200	
2	Downspout	1	1	70	NAVY: Whole yard •95% UCL of geometric mean--140 mg/kg •Area-weighted average--89 mg/kg DTSC: •Patio area sample-weighted average--460 mg/kg
2	Front yard	1	3	65	
2	Front yard	2	3	49	
2	Front yard	4	3	46	
2	Front yard	7	3	80	
2	Front yard	12	3	28	
2	Front yard	18	3	35	
2	Back yard	1	3	91	
2	Back yard	2	3	91	Combined Data for Phases 1, 2, and 3 NAVY: Whole yard Average--100 mg/kg Patio Average: --43 mg/kg (Excludes value of 1,200 mg/kg from Phase 1 data) DTSC: Back yard (including patio) •Sample-weighted average--370 mg/kg •Patio, Sample-weighted average--460 mg/kg
2	Back yard	4	3	720	
2	Back yard	7	3	91	
2	Back yard	12	3	120	
2	Back yard	18	3	38	
2	Patio	1	3	43	
2	Side yard	1	1	35	
3	Side yard	1	5	63	

^a Distance from house foundation

CONCLUSIONS

- HUD guidance incorporates risk management decisions and cost considerations at the beginning to produce generic rules; CERCLA guidance uses risk assessment results to guide site-specific risk management decisions at the end of the process.
- HUD guidance minimally characterizes LBP hazard. Methods such as compositing samples can mask hot spots.
- A reasonable maximum exposure area was smaller than an entire yard.
- High variability requires sampling a higher percent of housing units.
- Site-specific hazards should be assessed with a model such as LeadSpread.
- When lead is present at 40 to-1200 mg/kg, "control measures" recommended by HUD guidance must be considered interim, not a permanent remedy preferred by CERCLA.
- Because young children are the sensitive receptors, public acceptance of site characterization and remedial action is especially important.

REFERENCES

California Department of Toxic Substances Control, 2000. LeadSpread model, Version 7. Web address is www.dtsc.ca.gov/.

U.S. Department of Housing and Urban Development, 1995. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing. June, 1995.

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